TO LIBRARIAN
M.S. 27-14

INSTRUCTION MANUAL
FOR
STODDART
91263-1 IMPULSE GENERATOR

STODDART
AIRCRAFT RADIO CO., INC.
6644 SANTA MONICA BOULEVARD • HOLLYWOOD 38, CALIFORNIA
HOLLYWOOD 4-9292

electronic research • development • manufacturing

Please return to Librarian 6-7744
Mail Stop 26-73
Manual #2

PLEASE RETURN TO LIBRARIAN
ORG. 6-7744 M.S. 27-14
manual # 4

INSTRUCTION MANUAL
FOR
STODDART
91263-1 IMPULSE GENERATOR

* * * * *

Revised 21 August 1959

STODDART AIRCRAFT RADIO CO., INC.
6644 SANTA MONICA BOULEVARD
HOLLYWOOD 38, CALIFORNIA

91263-1 IMPULSE GENERATOR

wideband spectral output

There are well over a dozen known uses for the device, and probably many more that will occur to prospective users. Its more prominent uses include:

- To check RI-FI* meter calibration
- For substitution-type RI-FI* measurements of impulse signals
- Bandwidth determination
- A rapid gain check for VHF and UHF tuners
- As a standard signal source for constantly monitoring the performance of radar and pulse-operated receivers
- Testing the effectiveness of noise suppression filters and wave filters
- The study of methods of noise suppression in radio receivers
- Receiver alignment

*Radio Interference — Field Intensity

The Stoddart 91263-1 Impulse Generator is the only generator of its kind with a spectral output that is **really** flat over the frequency range of 10 kilocycles to 1000 megacycles. A maximum output of 101 db above one microvolt-per-megacycle is provided, adjustable in one-quarter db steps from 10 db to the maximum output. The output circuit is designed to work into a 50-ohm load. The repetition rate is 60 pulses-per-second, each pulse having a duration of 0.0005 microseconds. Power requirements are approximately 30 watts at 105 to 125 volts ac, 60 cps.

A front panel switch enables the choice of negative or positive pulses.

The generator is housed in an attractive dark green hammertone-finished aluminum case, and is designed to "stay put" on the work bench regardless of the moving of connected cables or the manipulation of any of the front-panel switches.

SPECIFICATIONS

MAXIMUM OUTPUT: 101 db above one microvolt-per-megacycle into 50-ohm load.

PULSE REPETITION RATE: 60 pps

PULSE WIDTH: 0.0005 microseconds

POWER REQUIREMENT: 30 watts at 105 to 125 volts ac, 60 cps.

SPECTRAL INTENSITY: flat within ±0.5 db from 10 kcs to 1000 mcs, useful output through 10 kmc.

STODDART *Aircraft Radio Co., Inc.*

6644 SANTA MONICA BLVD., HOLLYWOOD 38, CALIFORNIA · HOLLYWOOD 4-9294

TABLE OF CONTENTS

Page

SECTION 1 - GENERAL DESCRIPTION

1. Scope of this Manual 1
2. Purpose and Basic Principles 1
3. Electrical Characteristics 1
   3a. Frequency Range 1
   3b. Pulse Duration 1
   3c. Repetition Rate 1
   3d. Output Impedance 1
   3e. Output Level 2
   3f. Pulse Polarity 2
   3g. Power Requirements 2
4. Mechanical Characteristics 2
   4a. Dimensions 2
   4b. Weight 2

SECTION 2 - THEORY OF OPERATION

1. General Theory of Operation 3
2. Circuit Analysis 3
   2a. Transmission Line 3
   2b. Power Supply 4
   2c. Polarity Reversing Circuit 5
   2d. Attenuator 5

SECTION 3 - INSTALLATION

1. Scope of this Section 6
2. Power Supply Requirements 6
3. Initial Equipment Setup 6
   3a. Setup 6
4. Electrical Adjustments 7

TABLE OF CONTENTS (Cont'd.) Page

SECTION 4 - OPERATION

1. General 8

2. Operating Instructions 8
   2a. Load Impedance 8
   2b. Output Signal 8
   2c. Pulse Polarity 9
   2d. Detecting Instrument Overload 9

3. Impulse Interference Measurement 11
   3a. Measuring small impulse signal levels . 11
   3b. Measuring large impulse signal levels . 13

4. Bandwidth Measurement 15

SECTION 5 - MAINTENANCE

1. Introduction 21

2. Localization of Trouble 21
   2a. Introduction 21

3. Removal of Chassis from Instrument Case. 22

4. Impulse Generator Trouble Shooting & Repair . . 22
   4a. Tube Replacement 22
   4b. Trouble Shooting 23
   4c. Replacement of parts 23

SECTION 6 - PARTS LIST

1. Introduction 26

2. Maintenance Parts List 26

3. List of Manufacturers 26

SECTION I

GENERAL DESCRIPTION

1. SCOPE OF THIS MANUAL

This instruction book contains instructions for the installation, operation and maintenance of the Stoddart Model 91263-1 Impulse Generator. Section 6 of this manual contains a list of component parts.

2. PURPOSE AND BASIC PRINCIPLES

The Model 91263-1 Impulse Generator equipment provides pulse signals of very short duration and of constant amplitude. The short pulse duration provides a broadband radio frequency output that is essentially constant per unit bandwidth from 60 kilocycles to 1000 megacycles.

The impulse generator can be used as a secondary standard of broadband radio interference. It can be used to calibrate or determine the performance of RI-FI equipment, radio communication receivers and amplifiers in its frequency range.

3. ELECTRICAL CHARACTERISTICS

3a. FREQUENCY RANGE:
60 kilocycles to 1000 megacycles, output constant within ±0.5 db. Useful output to 10,000 megacycles.

3b. PULSE DURATION:
0.0005 microseconds (5×10^{-10} seconds)

3c. REPETITION RATE:
50 to 60 pulses-per-second, determined by power line frequency.

3d. OUTPUT IMPEDANCE:
Matches 50 ohm impedance. The load must include a dc resistance of 50 ohms for proper operation.

3e. OUTPUT LEVEL: *

101 db above one microvolt-per-megacycles bandwidth, adjustable from 10 to 101 db in 0.25 steps.

3f. PULSE POLARITY:

Front panel switch provides choice of positive or negative pulses.

3g. POWER REQUIREMENTS:

115 volts, 50-60 cycles, 30 watts.

4. MECHANICAL CHARACTERISTICS

4a. DIMENSIONS:

10 inches wide, 9-1/4 inches deep, 7-3/8 inches high.

4b. WEIGHT:

9-1/2 pounds.

* The output has been calibrated in terms of rms spectral intensity. Or, impulse output is in terms of rms of a sine wave (0.707 of true peak of a sine wave) which would have the same peak amplitude as the impulse signal.

SECTION 2
THEORY OF OPERATION

1. GENERAL THEORY OF OPERATION

The Model 91263-1 Impulse Generator produces electrical pulses which are so short in duration as to have a frequency spectrum that is essentially flat from 60 kilocycles to 1000 megacycles. The scheme used in this equipment for the production of short pulses consists of charging and discharging a transmission line whose resonant frequency is about 1400 megacycles. The pulse amplitude and the RF power output can be varied simply by changing the d.c. charging potential.

2. CIRCUIT ANALYSIS

2a. TRANSMISSION LINE:

The heart of the generator consists of a short section of open-circuited coaxial line. The outer conductor is held at ground potential while one end of the inner conductor is connected to a calibrated voltage source through a high resistance. A mercury switch is connected in series with the other end of the inner line and the 50 ohm output circuit. Periodically the mercury switch closes, discharging the line across the 50 ohm load.

The mercury switch contacts are operated by a pulsating magnetic field generated by a coil that surrounds the line. The coil is periodically energized at power line frequency from a 6.3 volt power transformer secondary winding and a half-wave selenium rectifier.

By making the charging resistance several megohms the inner line remains effectively open-circuited at that end during the very short period required for discharging the

line through the mercury contacts. Yet line capacity is so small that the RC time constant for recharging is very short compared to the charging time of approximately 8 milliseconds when the mercury switch contacts are open. The line parameters were so chosen that at the instant of discharge its self-resonant frequency as a quarter wave open-circuited transmission line is in the vicinity of 1400 megacycles. This ensures that spectral output per unit bandwidth will be substantially constant up to 1000 megacycles.

2b. POWER SUPPLY:

The self-contained power supply is designed to operate from a single-phase source, 105 to 125 volts, 50 to 60 cycles.

The input power for the line charging voltage is obtained from the secondary winding (terminals 3 and 4) of transformer T101 and is rectified by selenium stack CR101 through CR105. The half-wave rectified output is filtered by shunt capacitor C101 and series dropping resistor R101. Voltage regulation and additional filtering is achieved by four gaseous regulator tubes, V101 thru V104, in series to provide a final output voltage of approximately 600 volts. This circuit, from the transformer winding to the output of regulator tubes, is connected to ground only through switch S102 (polarity).

In order to provide high voltage indication, neon lamp DS101 (HV REGULATOR ON) and resistor R129 are shunted across the regulator resistor R101. The lamp DS101 will not light for either of these conditions:

a. Power supply defective
b. Gaseous regulator tubes V101 through V104 defective (but HV

available, unregulated)

2c. POLARITY REVERSING CIRCUIT:

By reversing the charging voltage to the impulse generator line the polarity of the output pulse can be reversed. Control over the pulse polarity has many operational advantages. Polarity switch S102 provides this control by reversing the connections of ground and voltage output across the regulator string V101 through V104.

2d. ATTENUATOR:

The spectral output of the impulse generator is directly proportional to the charging potential. Accordingly, a very accurate voltage divider-type step attenuator has been placed between the voltage output from polarity switch S102 and ground and the charging potential for the impulse line is taken from the divider output.

The individual resistors from which the voltage divider is assembled are accurate to one percent. This ensures good overall attenuator accuracy.

The number of attenuator steps and the resistor values were chosen so that the impulse generator output can be varied from 10 to 101 db above one microvolt-per-megacycle in 0.25 db steps.

Differences exist in the inherent output between individual impulse generators. Therefore each equipment is set to the correct output by adjusting internal voltage control R103.

SECTION 3

INSTALLATION

1. SCOPE OF THIS SECTION

Procedures for setting up the 91263-1 Impulse Generator for operation are contained in this section; actual operating procedures are contained in the succeeding Section 4, Operation. The impulse generator is portable equipment and no provisions are made for permanent mounting or fixed installation.

2. POWER SUPPLY REQUIREMENTS

This equipment must be operated at 105 - 125 volts ac, single phase, 50 to 60 cycles per second. Power consumption is approximately 30 watts at 115 volts, 60 cycles.

3. INITIAL EQUIPMENT SETUP

3a. SETUP:

Step 1. Place the impulse generator equipment on a convenient bench or other flat surface, on the four feet provided.

WARNING

BECAUSE OF THE MERCURY
SWITCH THE GENERATOR WILL
NOT OPERATE SATISFACTORILY
IF THE EQUIPMENT IS TILTED
GREATER THAN 30 DEGREES
FROM VERTICAL.

Step 2. One (1) ampere fuses must be in the fuse holder.

Step 3. Connect the plug on the end of the power cable to an external power source. The power line cable uses a

three-pronged, polarized male plug - the third pin carrying the grounding circuits. A two-contact adapter is supplied for use with the three-pronged plug when a three-pin power receptacle is not available. When using the adapter connect a good ground to the adapter grounding wire.

4. ELECTRICAL ADJUSTMENTS

All internal alignment and calibration adjustments on the impulse generator are made at the factory and no further adjustment is required prior to operation.

SECTION 4

OPERATION

1. GENERAL

Turn the "POWER" switch to "ON".

No equipment warm up period is required.

NOTE

THIS EQUIPMENT SHOULD NOT BE OPERATED UNLESS THE "HV REGULATOR ON" INDICATOR IS LIGHTED. THE LAMP SERVES TO INDICATE "POWER ON" CONDITIONS AND OPERATION OF THE VOLTAGE REGULATOR TUBES IN CHARGING VOLTAGE CIRCUIT.

2. OPERATING INSTRUCTIONS

2a. LOAD IMPEDANCE

The impulse generator is designed to work into a 50 ohm resistive load. Therefore, connect the output of the impulse generator to the load by a 50 ohm coaxial cable remembering that the accuracy of output is dependent on the load impedance.

2b. OUTPUT SIGNAL

The output from the impulse generator is in terms of db above one microvolt-per-megacycle and its level is the sum of the db values indicated by the three attenuator dials.

The pulse output from the generator is an impulse signal. A pulse is considered "impulsive" when its duration is very much less than the reciprocal of the bandwidth of

the detecting instrument. Stated differently, a pulse is considered impulsive when the overall rise time of the detecting instrument is long compared to the pulse duration. The generator output would no longer be considered impulsive when the detecting instrument rise time approached the pulse duration. For example: With a pulse duration of 0.0005 microseconds time, and a bandpass type circuit, the bandwidth would need to be approximately:

$$B = \frac{0.7}{T} = \frac{0.7}{.0005} = 1400 \text{ megacycles.},$$

where:

B = bandwidth 3 db down in megacycles.

T = rise time of bandpass circuit in microseconds.

For all practical purposes the output of this generator can be considered impulsive. For the practical detecting instrument used below 1000 megacycles and subject to impulsive signal input, the output will be inversely proportional to rise time and directly proportional to bandwidth.

2c. PULSE POLARITY

The polarity of the output pulse can be selected, as desired, with the front panel control marked "PULSE POLARITY", "POS-NEG".

2d. DETECTING INSTRUMENT OVERLOAD

Always be watchful of receiver overload when operating with the broadband output from the impulse generator. Overload is indicated if the receiver output changes when the generator pulse polarity is reversed. Since the generator output level does not change with polarity reversal, the change must be due to receiver overload. The input level at which the receiver overloads can be

determined by increasing the generator output by constant increments and noting the level at which the receiver output becomes non-linear.

Overload usually occurs in the first stage of an amplifier or receiver. This is because of insufficient selectivity ahead of the first tube. This results in excessive pulse signal amplitude as explained in paragraph 2b, above. Should this happen, the following corrective steps should be taken:

(1) Increase the i.f. amplifier gain to maximum. This permits the same output level indication with a lower input signal.

(2) Should receiver overload persist check the alignment of the "front-end" tuned circuits.

(3) Overload may be due to spurious responses of the input circuits to higher frequencies. In this case use a low-pass filter at the receiver input. The filter cut-off frequency should be as close as practicable above the highest operating frequency.

When using a Radio Interference and Field Intensity equipment in the Field Intensity (FI) or Quasi-Peak (QP) detector function positions, overload can be aggrevated because of the low "duty cycle" of the impulse signal. At 60 pulses-per-second the "average" voltage appearing at the detector and indicated by the FI function will be negligible unless the bandwidth is extremely narrow. This means the input signal amplitude will have to be increased many times that required of the PEAK (slide-back) detector function. The QP detector function is much better than the FI function because its charge and discharge time constants (1ms charge and 600 ms discharge, standard accepted constants) do not permit com-

plete voltage buildup. When permissible, the final step to be taken to eliminate overload is to use a detector function most immune to the affects of low pulse repetition rate.

3. IMPULSE INTERFERENCE MEASUREMENT

The Model 91263-1 Impulse Generator is an excellent calibrating standard for use with Radio Interference and Field Intensity equipment. For RI-FI meters not equipped with an internal impulse generator an external generator is a time saver in the measurement of impulse interference. Its use permits the measurement of impulse signals directly in terms of microvolts-per-kilocycle or in db above one microvolt-per-megacycle without involving bandwidth computations.

3a. MEASURING SMALL IMPULSE SIGNAL LEVELS

The following procedure is for measuring signal levels that do not exceed 112,000 microvolts-per-megacycle or 112 microvolts-per-kilocycle. This method can only be used with 50 ohm resistive input circuits.

Step 1. Take a PEAK or "slide-back" measurement of the impulsive interference signal with the RI-FI equipment. There is no need to standardize the gain of the equipment but it is advisable to operate with the lowest attenuator step and the highest i.f. amplifier gain setting practicable. See paragraph 2e above.

Step 2. Without disturbing the RI-FI meter controls substitute the impulse generator signal for the unknown signal. Adjust the generator output level for the same slide-back indication noted in Step 1 above.

Step 3. For conductive measurements the unknown signal level (across the RI-FI meter 50-ohm resistive input terminals) is equal to the output of the impulse generator. The output can be read directly from the attenuator controls and is in terms of db above one

Microvolt-per-megacycle bandwidth. To change the reading to microvolts-per-kilocycle subtract 60 db and convert the remaining db value to voltage ratio by means of Table II.

When measuring radiated impulse interference with a pick-up device, multiply the final reading of Step 3 by the antenna factor to obtain the "slide-back" value of field intensity in microvolts-per-meter-per-kilocycle. This measurement is only possible with pick-up devices that are designed to work into a 50-ohm circuit, for example, the antennas and probes used with the AN/URM-17, NM-50 and AN/URM-47, NM-30, equipments.

NOTE

THE NM-30A AND AN/URM-47A EQUIPMENTS DO NOT PRESENT A 50-OHM DC PATH FOR THE IMPULSE GENERATOR. THEREFORE A STODDART ATTENUATOR NO. 90530-10 OR EQUIVALENT MUST BE CONNECTED BETWEEN THE IMPULSE GENERATOR AND THE RECEIVING EQUIPMENT.

Error due to cable losses will be eliminated if the same cable is used between impulse generator and RI-FI meter as between the pick-up device and RI-FI meter. This treatment also applies to conducted interference measurements.

EXAMPLE

Assume a pick-up device factor of 7 and a signal level, as read on the impulse generator, of 81 db above one microvolt-per-megacycle. Find:

(1) The field intensity in db above one microvolt-

per-meter-per-megacycle.

(2) The field intensity in microvolts-per-meter-per-kilocycle. From Table I a voltage ratio (antenna factor) of 7 is 16.9 db. The field intensity in db above one microvolt-per-meter-per-megacycle will be the sum of the signal level in db, across 50 ohms, plus the antenna factor in db.

81 db + 16.9 db = 97.9 db above one microvolt-per-meter-per-megacycle

Converting the signal level to a db above one microvolt-per-kilocycle basis,

81 db - 60 db = 21 db above one microvolt-per-kilocycle

From Tables IIa and IIb, 21 db is equivalent to a voltage ratio of 11.22. The signal level across 50 ohms if then 11.22 microvolts-per-kilocycle. Multiplying this by the antenna factor gives the field intensity of

11.22 x 7 = 78.54 microvolts-per-meter-per-kilocycle

3b. MEASURING LARGE IMPULSE SIGNAL LEVELS

The maximum output of the impulse generator is 112,000 microvolts-per-megacycle of 112 microvolts-per-kilocycle. When the unknown signal level exceeds this the following measurement procedure is recommended. This method can only be used with 50 ohm resistive input circuits.

Step 1. Take a PEAK or "slide-back" measurement of the impulsive interference signal with the RI-FI equipment. There is no need to standardize the gain of the equipment but it is advisable to operate with the lowest attenuator step and the highest i.f. amplifier gain setting practicable. See paragraph 2e, above.

Step 2. Substitute the impulse generator signal for the unknown signal. Adjust the impulse generator output level to 100 db above one microvolt-per-megacycle. Then, by adjusting only the RI-FI meter PEAK (Slide-back) and Attenuator controls take a "slide-back" reading of the impulse generator output.

Step 3. Subtract the RI-FI meter reading (meter scale reading in db plus the attenuator setting in db) of the impulse generator output in Step 2 from the RI-FI meter reading of the signal of Step 1. This difference in db plus 100 db is the signal level in db above one microvolt-per-megacycle. To change the reading to microvolts-per-kilocycle subtract 60 db and convert the remaining db value to voltage ratio by means of Table II.

When measuring radiated impulse interference with a pickup device, multiply the final reading of Step 3 by the antenna factor to obtain the PEAK value of field intensity in microvolts-per-meter-per-kilocycle.

NOTE

THIS MEASUREMENT IS ONLY POSSIBLE WITH PICKUP DEVICES THAT ARE DESIGNED TO WORK INTO A 50 OHM RESISTIVE CIRCUIT. ERROR DUE TO CABLE LOSSES WILL BE ELIMINATED IF THE SAME CABLE IS USED BETWEEN THE IMPULSE GENERATOR AND RI-FI METER AS BETWEEN THE PICKUP DEVICE AND RI-FI METER. THIS ALSO APPLIES TO THE MEASUREMENT OF CONDUCTED INTERFERENCE.

EXAMPLE

Assume a pickup device factor of 15,
a Step 1 measurement of 130 db and
a Step 2 measurement of 106 db.
The signal level is:
130 db - 106 db + 100 db = 124 db
above one microvolt-per-megacycle.
or 64 db above one microvolt-per-kilocycle
From Tables IIa and IIb 64 db is a voltage ratio of 1,585. The voltage across the RI-FI meter 50 ohm input terminals is then 1,585 microvolts-per-kilocycle.
The field intensity is:
1,585 x 15 = 23,775 microvolts-per-meter-per-kilocycle

4. BANDWIDTH MEASUREMENT

The impulse bandwidth of a receiver or amplifier can be measured at any frequency up to 1000 mcs by comparing the sine wave sensitivity with the impulse sensitivity. Since the impulse generator output is constant per unit bandwidth up to 1000 megacycles, any change in the impulse sensitivity not attended by a proportionate change in the sine wave sensitivity is an indication of change in bandwidth.

The following procedure can be used for determining impulse bandwidth of an RI-FI meter or any receiver or amplifier equipped with a "slide-back" detector.

Step 1. Adjust the output of the impulse generator at some convenient level well above the internal noise level of the equipment under test. Adjust the equipment "slide-back" control so the impulse generator signal is just above the cut-off point.

NOTE

OVERLOAD PRECAUTIONS MUST BE OBSERVED DURING THIS PORTION OF THE BANDWIDTH MEASUREMENT. SEE PARAGRAPH 2e, ABOVE.

Step 2. Without changing any equipment controls substitute an accurate sine wave generator for the impulse generator. Tune the generator frequency to exact center frequency of equipment under test. Adjust generator output level for the same "slide-back" just above cut-off point reading as in Step 1 above. A very low level of modulation may be used as an aid in determining this point. Note the sine wave generator output.

NOTE

THE SINE WAVE GENERATOR MUST HAVE A 50 OHM OUTPUT IMPEDANCE AND BOTH GENERATORS MUST BE WORKING INTO THE SAME 50 OHM LOAD. AT HIGHER FREQUENCIES THE SAME 50 OHM RF CABLE SHOULD BE USED SO CABLE LOSSES WILL BE IDENTICAL.

Step 3. The impulse bandwidth can then be found by dividing the sine wave generator output in microvolts by the impulse generator output in microvolts-per-megacycle.

EXAMPLE

Assume a Step 1 impulse generator level of 60 db above one microvolt-per-megacycle and a Step 2 sine wave generator output of 200 microvolts. Determine the impulse bandwidth.

From Table IIa and IIb, the impulse

bandwidth is:

$$\frac{200\ \mu v}{1000\ \mu v/mc} = 0.2 \text{ megacycle or } 200 \text{ kilocycles}$$

TABLE I

The following table is for converting voltage ratios into db values. For voltage ratios greater than 10.0 but less than 100, divide by 10 and add 20 db to the db value found in the following table for the quotient. For voltage ratios greater than 100 but less than 1000, divide by 100 and add 40 db to the value found in the table for the quotient, and so on.

VOLTAGE RATIO	Plus Fractional Part .00	.05	VOLTAGE RATIO	Plus Fractional Part .00	.05
	db	db		db	db
1.0	.000	.424	5.5	14.807	14.886
1.1	.828	1.214	5.6	14.964	15.041
1.2	1.584	1.938	5.7	15.117	15.193
1.3	2.279	2.607	5.8	15.269	15.343
1.4	2.923	3.227	5.9	15.417	15.490
1.5	3.522	3.807	6.0	15.563	15.635
1.6	4.082	4.350	6.1	15.707	15.778
1.7	4.609	4.861	6.2	15.848	15.918
1.8	5.105	5.343	6.3	15.987	16.055
1.9	5.575	5.801	6.4	16.124	16.191
2.0	6.021	6.235	6.5	16.258	16.325
2.1	6.444	6.649	6.6	16.391	16.456
2.2	6.848	7.044	6.7	16.521	16.586
2.3	7.235	7.421	6.8	16.650	16.714
2.4	7.604	7.783	6.9	16.777	16.840
2.5	7.959	8.131	7.0	16.902	16.964
2.6	8.299	8.465	7.1	17.025	17.086
2.7	8.627	8.787	7.2	17.147	17.207
2.8	8.943	9.097	7.3	17.266	17.326
2.9	9.248	9.396	7.4	17.385	17.443
3.0	9.542	9.686	7.5	17.501	17.559
3.1	9.827	9.966	7.6	17.616	17.673
3.2	10.103	10.238	7.7	17.730	17.786
3.3	10.370	10.501	7.8	17.842	17.897
3.4	10.630	10.756	7.9	17.953	18.007
3.5	10.881	11.005	8.0	18.062	18.116
3.6	11.126	11.246	8.1	18.170	18.223
3.7	11.364	11.481	8.2	18.276	18.329
3.8	11.596	11.709	8.3	18.382	18.434
3.9	11.821	11.932	8.4	18.486	18.537
4.0	12.041	12.149	8.5	18.588	18.639
4.1	12.256	12.361	8.6	18.690	18.740
4.2	12.465	12.568	8.7	18.790	18.840
4.3	12.669	12.770	8.8	18.890	18.939
4.4	12.869	12.967	8.9	18.988	19.036
4.5	13.064	13.160	9.0	19.085	19.133
4.6	13.255	13.349	9.1	19.181	19.228
4.7	13.442	13.534	9.2	19.276	19.323
4.8	13.625	13.715	9.3	19.370	19.416
4.9	13.804	13.892	9.4	19.463	19.509
5.0	13.979	14.066	9.5	19.554	19.600
5.1	14.151	14.236	9.6	19.645	19.691
5.2	14.320	14.403	9.7	19.735	19.780
5.3	14.486	14.567	9.8	19.825	19.869
5.4	14.648	14.728	9.9	19.913	19.956
			10.0	20.000	20.043

TABLE II

The following table is for converting db values into voltage ratios. For db values greater than 20 db but less than 40 db, subtract 20 db and move the decimal point one position to the right in the voltage ratio found in Table IIb for the remainder. For db values greater than 40 db but less than 60 db, subtract 40 db and move the decimal point 2 places to the right, see Table IIa.

TABLE IIa

db VALUE RANGE	SUBTRACT db	NUMBER OF PLACES TO MOVE VOLTAGE RATIO DECIMAL POINT TO THE RIGHT.
0- 20	0	0
20- 40	20	1
40- 60	40	2
60- 80	60	3
80-100	80	4
100-120	100	5
120-140	120	6
140-160	140	7

TABLE IIb

db Value	.00	.25	.50	.75
0	1.000	1.029	1.059	1.090
1	1.122	1.154	1.189	1.223
2	1.259	1.296	1.334	1.373
3	1.413	1.453	1.496	1.540
4	1.585	1.631	1.679	1.728
5	1.778	1.831	1.884	1.939
6	1.995	2.054	2.113	2.176
7	2.239	2.304	2.371	2.441
8	2.512	2.585	2.661	2.739
9	2.818	2.900	2.985	3.072
10	3.162	3.255	3.350	3.447
11	3.548	3.652	3.758	3.868
12	3.981	4.097	4.217	4.340
13	4.467	4.597	4.732	4.870
14	5.012	5.159	5.309	5.464
15	5.623	5.787	5.957	6.131
16	6.310	6.494	6.683	6.879
17	7.079	7.286	7.499	7.718
18	7.943	8.175	8.414	8.660
19	8.913	9.173	9.441	9.717
20	10.000			

SECTION 5

MAINTENANCE

1. INTRODUCTION

The procedure, illustrations, and tables in this section are for the purpose of assisting maintenance personnel in the repair of the #91263-1 Impulse Generator. When the equipment has failed in operation, the source must be located, the defect remedied, and the equipment restored to operation. The information is, therefore, presented in the following order.

Localization of Trouble (paragraph 2)

Removal of Chassis from Instrument Case. (para. 3)

Impulse Generator Trouble Shooting and Repair

An overall schematic is provided at the end of this section. A table of tube operating voltages immediately precedes the schematic.

2. LOCALIZATION OF TROUBLE

2a. INTRODUCTION

Trouble shooting in the impulse generator can be accomplished in the same manner as any other electronic equipment. Inspect the entire assembly in an attempt to isolate the trouble. Determine that the required power is applied to the equipment. The indicator lamp DS101 serves to indicate power application and operation of the voltage regulator tubes. Determine whether or not an output can be obtained from the impulse generator.

WARNING

The Impulse Generator operates at high dc voltages. The power source should be disconnected before removing the case from the impulse generator.

3. REMOVAL OF CHASSIS FROM INSTRUMENT CASE

After determining that the source of trouble is in the impulse generator, the next procedure is to remove the equipment from the case.

To open the impulse generator, stand the unit on its panel guards, face down. Remove E105, the adapter at the end of the 6 ft. power cord. Remove the two screws from the rear of case and slide the case off the chassis. Pull the cable through the relief hole in the case.

The equipment is reassembled in essentially the reverse sequence as given for removal.

4. IMPULSE GENERATOR TROUBLE SHOOTING AND REPAIR

WARNING

The impulse generator line #91396-1, Z101, is located near the panel edge of the chassis. Extreme care should be exercised when handling or replacing this assembly. Z101 utilizes a glass-encased mercury switch containing an inert gas under pressure.

4a. TUBE REPLACEMENT

The miniature tubes of this equipment are held in place by spring-loaded tube shields. To remove, depress and turn the tube shield counter-clockwise, then lift. Do not remove any tube without first turning off the equipment.

The four 0A2 gaseous tubes (V101, V102, V103, V104) are located along the rear of the chassis. An indication of defective tube is the absence of a bluish glow near the base of the tube and non-operation of the HV REGULATOR on lamp when power switch is in ON position.

4b. TROUBLE SHOOTING

If there is no output pulse detected from the impulse generator, check the following, with attenuator switches set for 101 db above 1 microvolt-per-mega-cycle and polarity switch in positive position.

(1) Examine the one-ampere fuse F101

(2) The voltage at the top of impulse generator line Z101 should be approximately 600 volts dc with respect to chassis as measured with a 20,000 ohm-per-volt meter. If the voltage departs by more than 10%, check for defective V101, V102, V103, V104, CR101, CR102, CR103, CR104, CR105, C101 or R101.

(3) A 50 to 60 cycle buzzing should be audible in the impulse line Z101. If this sound is not present check the coil driving voltage Z101. Measure this voltage across the two coil leads extending from Z101. This voltage should be approximately 5 volts pulsating dc. This measurement can be made with an oscilloscope. A cause of insufficient drive voltage could be a defective CR106 rectifier or a shorted driving coil.

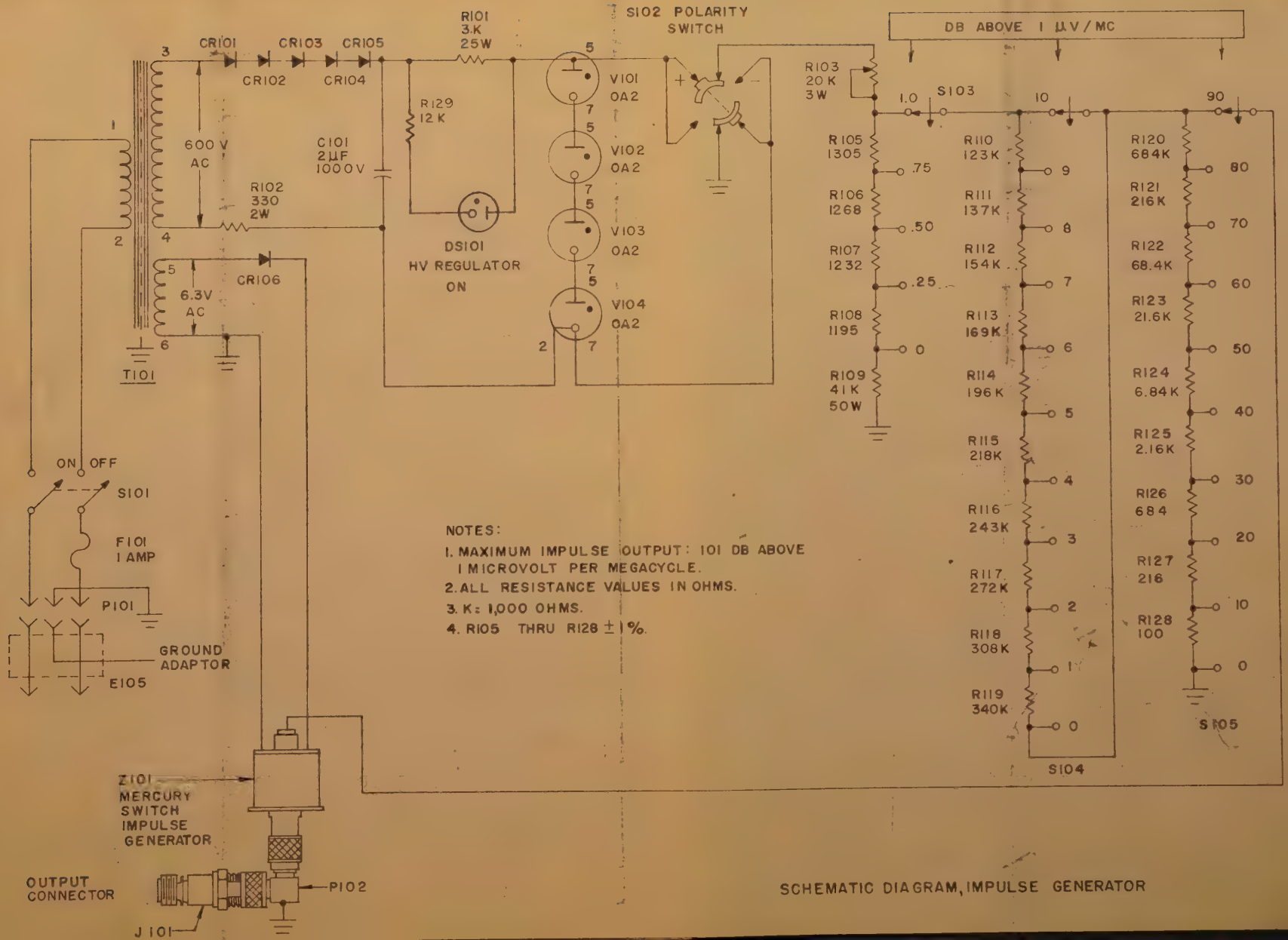
4c. REPLACEMENT OF PARTS

Defective parts should be replaced with correct parts as listed in Section 6.

TABLE III - TUBE OPERATING VOLTAGES

SYMBOL	TUBE TYPE	FUNCTION	PLATE Pin #5	CATHODE Pin #7
V101	0A2	Voltage Regulator	600	450
V102	0A2	Voltage Regulator	450	300
V103	0A2	Voltage Regulator	300	150
V104	0A2	Voltage Regulator	150	0

1. All voltages measured with 20,000 ohm-per-voltmeter.
2. All measurements are made from the point indicated to chassis.
3. All measurements made with attenuator switches adjusted for maximum output and polarity switch in POSITIVE position.



NOTES:

1. MAXIMUM IMPULSE OUTPUT: 101 DB ABOVE 1 MICROVOLT PER MEGACYCLE.
2. ALL RESISTANCE VALUES IN OHMS.
3. K = 1,000 OHMS.
4. R105 THRU R128 ± 1%.

SCHEMATIC DIAGRAM, IMPULSE GENERATOR

SECTION 6

PARTS LIST

1. INTRODUCTION

Reference symbols have been assigned to identify all maintenance parts of the equipment. They are used for marking the equipment (adjacent to the part they identify) and are included in the drawings, diagrams and the parts list. The letter of the reference designation indicates the kind of part (generic group), such as resistor or electron tube. Sockets associated with particular plug-in devices, such as electron tubes or fuses are identified by a reference designation which includes the reference designation of the plug-in device. For example, the socket for tube V101 is designated XV101.

2. MAINTENANCE PARTS LIST

Table 1 lists all the maintenance parts required for the Impulse Generator. Column 1 lists the reference series of the major unit, followed by the reference designations of the various parts in alphabetical and numberical order. Column 2 refers to the notes applicable to those items that require such notes for manufacturer design, listed for reference only, Federal procurement data, etc. Column 3 gives the name and describes the various parts. Complete information is given for all key parts (parts differing from any part previously listed in this table) and sub-key parts (parts identical with a key part but appearing for the first time for a major unit. The name and description are omitted for other parts. However, reference is made to the key part or sub-key part for the data. Column 4 indicates how the part is used and gives its functional location in the equipment.

3. LIST OF MANUFACTURERS

Table 6-2 lists manufacturers of parts used in the equipment. The first column includes the abbreviations used in Table 6-1 to identify manufacturers.

TABLE 6-1. IMPULSE GENERATOR, MAINTENANCE PARTS LIST

Reference Symbol	Notes	Name and Description	Locating Function
C101		CAPACITOR, FIXED, ELECTROLYTIC, OIL-FILLED: 2 mfd; +20%; 1000 vdcw CAW #1010; CADV #10939	B+ Filter
CR101		RECTIFIER, METALLIC: selenium; single phase half wave circuit; input 130 vac; 380 v peak inverse voltage; output 65 max dc current; Int. Rect. Corp.#6RS065; CADV #10819	Rectifier, charge voltage
CR102		Same as CR101	Rectifier, charge voltage
CR103		Same as CR101	Rectifier, chg. volt.
CR104		Same as CR101	Rectifier, chg. volt.
CR105		Same as CR101	Rectifier, chg. volt.
CR106		RECTIFIER, METALLIC: selenium; single phase, half wave circuit; one plate; input 25 volts ac; output 150 ma max dc current; Int. Rect.Corp. #B1H; CADV #10943	Rectifier, coil voltage
DS101		LAMP, GLOW: 56 vdc average, maintaining volts; 0.2ma; 1-3/16 in. lg; T-3-1/4 bulb; min. bayonet base; CG# NE-51; CADV #NE-51	HV regulator on lamp
E101		SHIELD, ELECTRON TUBE: for 7-pin miniature socket; JAN-S-28A spec; JAN- #TS102U02; CADV #10039	Shield for V101
E102		Same as E101	Shield for V102
E103		Same as E101	Shield for V103

TABLE 6-1. IMPULSE GENERATOR, MAINTENANCE PARTS LIST

Reference Symbol	Notes	Name and Description	Locating Function
E104		Same as E101	Shield for V104
E105		ADAPTER, AC INPUT: adapts 3-conductor grounding cap circuit to 2-conductor plug; CHU; CADV 11146	AC input adapter
E106		KNOB, BAR: black phenolic; CALH #C-64969-1G; CADV #10134	0.25 db atten.step knob
E107		Same as E106	1.0 db atten.step knob
E108		Same as E106	10 db atten.step knob
E109		Same as E106	Polarity switch knob
F101		FUSE, CARTRIDGE: 1 amp at 250 v; CFA #AGC-1.0-250v; CADV #10739	AC line input fuse
F102		Same as F101	Spare fuse
J101		CONNECTOR, RECEPTACLE: coaxial; Type "N"; UG-30/U; CPH #8266; CADV #10946	Output connector
P101		PLUG: 3-conductor grounding cap; p/o W101; not replaceable; listed for reference only	AC input connector
P102		CONNECTOR, ADAPTER: coaxial;Type "N"; right-angle; UG-27C/U; CPH #82-213; CADV #10945	Output connector adapter
R101		RESISTOR, FIXED, WIREWOUND: 3,000 ohms; ±5%; 25 watts; Daleohm #RH25-3000; CADV #10705-302	Current limiting resistor

TABLE 6-1. IMPULSE GENERATOR, MAINTENANCE PARTS LIST

Reference Symbol	Notes	Name and Description	Locating Function
R102		RESISTOR, FIXED, COMPOSITION: 330 ohms; ±5%; 2 watts; CBZ #HB-3315; CADV #10377-331	Rectifier series resistor
R103		RESISTOR, VARIABLE, WIREWOUND: 20,000 ohms; ±10%; 3 watts; type linear taper; CMC #58C2-20K; CADV #10953	Output adjustment
R104		Not used	
R105		RESISTOR, FIXED, DEPOSITED CARBON: 1,305 ohms; ±1%; 1/2 watt; Daleohm; CADV #10935-7	0.25 db step attenuator
R106		RESISTOR, FIXED, DEPOSITED CARBON: 1,268 ohms; ±1%; 1/2 watt; Daleohm; CADV #10935-6	0.25 db step attenuator
R107		RESISTOR, FIXED, DEPOSITED CARBON: 1,232 ohms; ±1%; 1/2 watt; Daleohm; CADV #10935-5	0.25 db step attenuator
R108		RESISTOR, FIXED, DEPOSITED CARBON: 1,195 ohms; ±1%; 1/2 watt; Daleohm; CADV #10935-4	0.25 db step attenuator
R109		RESISTOR, FIXED, WIREWOUND: 41,000 ohms; ±1%; 50 watts; Daleohm; CADV #11132-413	0.25 db step attenuator
R110		RESISTOR, FIXED, DEPOSITED CARBON: 123,000 ohms; ±1%; 1/2 watt; Daleohm; CADV #10935-12	1.0 db step attenuator
R111		RESISTOR, FIXED, DEPOSITED CARBON: 137,000 ohms; ±1%; 1/2 watt; Daleohm; CADV #10935-13	1.0 db step attenuator
R112		RESISTOR, FIXED, DEPOSITED CARBON: 154,000 ohms; ±1%; 1/2 watt; Daleohm; CADV #10935-14	1.0 db step attenuator

TABLE 6-1. IMPULSE GENERATOR, MAINTENANCE PARTS LIST

Reference Symbol	Notes	Name and Description	Locating Function
R102		RESISTOR, FIXED, COMPOSITION: 330 ohms; ±5%; 2 watts; CBZ #HB-3315; CADV #10377-331	Rectifier series resistor
R103		RESISTOR, VARIABLE, WIREWOUND: 20,000 ohms; ±10%; 3 watts; type linear taper; CMC #58C2-20K; CADV #10953	Output adjustment
R104		Not used	
R105		RESISTOR, FIXED, DEPOSITED CARBON: 1,305 ohms; ±1%; 1/2 watt; Daleohm; CADV #10935-7	0.25 db step attenuator
R106		RESISTOR, FIXED, DEPOSITED CARBON: 1,268 ohms; ±1%; 1/2 watt; Daleohm; CADV #10935-6	0.25 db step attenuator
R107		RESISTOR, FIXED, DEPOSITED CARBON: 1,232 ohms; ±1%; 1/2 watt; Daleohm; CADV #10935-5	0.25 db step attenuator
R108		RESISTOR, FIXED, DEPOSITED CARBON: 1,195 ohms; ±1%; 1/2 watt; Daleohm; CADV #10935-4	0.25 db step attenuator
R109		RESISTOR, FIXED, WIREWOUND: 41,000 ohms; ±1%; 50 watts; Daleohm; CADV #11132-413	0.25 db step attenuator
R110		RESISTOR, FIXED, DEPOSITED CARBON: 123,000 ohms; ±1%; 1/2 watt; Daleohm; CADV #10935-12	1.0 db step attenuator
R111		RESISTOR, FIXED, DEPOSITED CARBON: 137,000 ohms; ±1%; 1/2 watt; Daleohm; CADV #10935-13	1.0 db step attenuator
R112		RESISTOR, FIXED, DEPOSITED CARBON: 154,000 ohms; ±1%; 1/2 watt; Daleohm; CADV #10935-14	1.0 db step attenuator

TABLE 6-1. IMPULSE GENERATOR, MAINTENANCE PARTS LIST

Reference Symbol	Notes	Name and Description	Locating Function
R113		RESISTOR, FIXED, DEPOSITED CARBON: 169,000 ohms; ±1%; 1/2 watt; Daleohm; CADV #10935-15	1.0 db step attenuator
R114		RESISTOR, FIXED, DEPOSITED CARBON: 196,000 ohms; ±1%; 1/2 watt; Daleohm; CADV #10935-16	1.0 db step attenuator
R115		RESISTOR, FIXED, DEPOSITED CARBON: 218,000 ohms; ±1%; 1/2 watt; Daleohm; CADV #10935-18	1.0 db step attenuator
R116		RESISTOR, FIXED, DEPOSITED CARBON: 243,000 ohms; ±1%; 1/2 watt; Daleohm; CADV #10935-19	1.0 db step attenuator
R117		RESISTOR, FIXED, DEPOSITED CARBON: 272,000 ohms; ±1%; 1/2 watt; Daleohm; CADV #10935-20	1.0 db step attenuator
R118		RESISTOR, FIXED, DEPOSITED CARBON: 308,000 ohms; ±1%; 1/2 watt; Daleohm; CADV #10935-21	1.0 db step attenuator
R119		RESISTOR, FIXED, DEPOSITED CARBON: 340,000 ohms; ±1%; 1/2 watt; Daleohm; CADV #10935-22	1.0 db step attenuator
R120		RESISTOR, FIXED, DEPOSITED CARBON: 684,000 ohms; ±1%; 1/2 watt; Daleohm; CADV #10935-23	10 db step attenuator
R121		RESISTOR, FIXED, DEPOSITED CARBON: 216,000 ohms; ±1%; 1/2 watt; Daleohm; CADV #10935-17	10 db step attenuator
R122		RESISTOR, FIXED, DEPOSITED CARBON: 68,400 ohms; ±1%; 1/2 watt; Daleohm; CADV #10935-11	10 db step attenuator
R123		RESISTOR, FIXED, DEPOSITED CARBON: 21,600 ohms; ±1%; 1/2 watt; Daleohm; CADV #10935-10	10 db step

TABLE 6-1. IMPULSE GENERATOR, MAINTENANCE PARTS LIST

Reference Symbol	Notes	Name and Description	Locating Function
R124		RESISTOR, FIXED, DEPOSITED CARBON: 6,840 ohms; ±1%; 1/2 watt; Daleohm; CADV #10935-9	10 db step attenuator
R125		RESISTOR, FIXED, DEPOSITED CARBON: 2,160 ohms; ±1%; 1/2 watt; Daleohm; CADV #10935-8	10 db step attenuator
R126		RESISTOR, FIXED, DEPOSITED CARBON: 684 ohms; ±1%; 1/2 watt; Daleohm; CADV #10935-3	10 db step attenuator
R127		RESISTOR, FIXED, DEPOSITED CARBON: 216 ohms; ±1%; 1/2 watt; Daleohm; CADV #10935-2	10 db step attenuator
R128		RESISTOR, FIXED, DEPOSITED CARBON: 100 ohms; ±1%; 1/2 watt; Daleohm; CADV #10935-1	10 db step attenuator
R129		RESISTOR, FIXED, COMPOSITION: 12,000 ohms; ±5%; 1/2 watt; CBZ #EB-1235; CADV #10011-123	10 db step attenuator
S101		SWITCH, TOGGLE: DPDT: 125 v, 3 amps; 250 v, 1 amp; CHH #20905; CADV #10172	power switch
S102		SWITCH, ROTARY: 2 positions; CADV #10933	polarity switch
S103		SWITCH, ROTARY: 5 positions; CADV #10936	0.25 db step attenuator switch
S104		SWITCH, ROTARY: 11 positions; CADV #10937	1.0 db step attenuator switch
S105		SWITCH, ROTARY: 10 positions; CADV #10934	10 db step attenuator switch

TABLE 6-1 IMPULSE GENERATOR, MAINTENANCE PARTS LIST

Reference Symbol	Notes	Name and Description	Locating Function
T101		TRANSFORMER, POWER: primary 115 volts; 50-60 cps; secondary #1, 600 volts at 40 ma; secondary #2, 6.3 volts at 1 amp; CAAC #5467-1; CADV #10940	power transformer
V101		ELECTRON TUBE: type 0A2	voltage regulator
V102		Same as V101	voltage regulator
V103		Same as V101	voltage regulator
V104		Same as V101	voltage regulator
W101		CABLE, POWER: 3 conductors; 6-1/2 feet long; P101 one end; CADV #91245-1	power input cable
XF101		HOLDER, FUSE: for 3 AG type fuse; CLF #3410-01; CADV #10018	fuse holder for F101
XF102		Same as XF101	spare fuse holder
XI101		SOCKET, LIGHT, INDICATOR: with lens; CEJ #147-1142; CADV #11441	I101 socket
XV101		SOCKET, TUBE: 7 contacts; miniature; CEB #TS102C01; CADV #10118	tube socket for V101
V102		Same as XV101	tube socket for V102
XV103		Same as XV101	tube socket for V103

TABLE 6-1. IMPULSE GENERATOR, MAINTENANCE PARTS LIST

Reference Symbol	Notes	Name and Description	Locating Function
XV104		Same as XV101	tube socket for V104
Z101		IMPULSE LINE: consists of one driving coil, one resistor, one coaxial line and one mercury switch; requires driving voltage of 6.3 volts pulsating dc at 50-60 pps repetition rate; charging voltage 600 volts dc for 101 db above one microvolt-per-megacycle output; output pulse width 0.0005 microsecond; pulse repetition rate 50-60 pps; CADV #91396-1	impulse generator

TABLE 6-2. IMPULSE GENERATOR, LIST OF MANUFACTURERS

ABBREVIATION	NAME	ADDRESS
CAW	Aerovox Wireless Corp.	700 Belleville Ave. New Bedford, Mass.
CBZ	Allen Bradley Co.	118 W. Greenfield Ave. Milwaukee, Wisconsin
CEB	Eby, Hugh H.	4700 Stenton Ave. Philadelphia, Pa.
CEJ	E.F. Johnson Co.	Waseco, Minn.
CFA	Bussman Mfg. Co.	2538 W. University St. St. Louis, Mo.
CHH	Arrow-Hart and Hedgeman Electric Co.	102 Hawthorne St. Hartford, Conn.
CHU	Harvey Hubbell, Inc.	447 Concord Ave. Bridgeport, Conn.
CLF	Littlefuse, Inc.	1865 Miner St. Des Plaines, Ill.
CMC	Clarostat Mfg. Co.	285-287 N. 6th. Street Brooklyn, New York
CPH	American Phenolic Corp.	1830 So. 54th. Ave. Chicago, Ill.
CAAC	New York Transformer Co.	26 Waverly Place New York, 3, N.Y.
CADV	Stoddart Aircraft Radio Co., Inc.	6644 Santa Monica Blvd. Hollywood 38, California
CALH	General Television & Radio Co.	1240 N. Holman Ave. Chicago 46, Ill.
Daleohm	Dale Products Inc.	1380 28th. Ave. Columbus, Nebraska
INT.RECT. CORP.	International Rectifier	1521 E. Grand Ave. El Segundo, California

STODDART

AIRCRAFT RADIO CO., INC.

serving 33 countries in Radio Interference control

www.manualsplus.com

1025720